PRSF 2.7.14

LWG
LOWER WILLAMETTE GROUP

PORTLAND HARBOR RI/FS
ROUND 3B BIOASSAY TESTING DATA REPORT

APRIL 21, 2008

DRAFT DOCUMENT: DO NOT QUOTE OR CITE
This document is currently under review by US EPA and its federal, state, and tribal partners, and is subject to change in whole or in part.

Prepared for:
The Lower Willamette Group

WE08-0002

Prepared by:

Windward environmental LLC
200 West Mercer Street, Suite 401 • Seattle, Washington • 98119

RECEIVED
APR 25 2008
Environmental
Cleanup Office

LWG
LOWER WILLAMETTE GROUP

April 21, 2008

Chip Humphrey
Eric Blischke
U.S. Environmental Protection Agency, Region 10
805 SW Broadway, Suite 500
Portland, OR 97205

Re: Submittal of the Round 3B Bioassay Testing Data Report

Dear Messrs. Humphrey and Blischke:

The Lower Willamette Group is pleased to submit the data report for the Round 3B toxicity testing of 56 Portland Harbor sediment samples and 4 upstream sediment samples.

Sincerely,

Jim McKenna

Bob Wyatt

cc: Confederated Tribes and Bands of the Yakama Nation
Confederated Tribes of the Grand Ronde Community of Oregon
Confederated Tribes of Siletz Indians of Oregon
Confederated Tribes of the Umatilla Indian Reservation
Confederated Tribes of the Warm Springs Reservation of Oregon
Nez Perce Tribe
Oregon Department of Fish & Wildlife
United States Fish & Wildlife
Oregon Department of Environmental Quality
LWG Legal
LWG Repository

LWG
LOWER WILLAMETTE GROUP

PORTLAND HARBOR RI/FS
ROUND 3B BIOASSAY TESTING
DATA REPORT

APRIL 21, 2008

DRAFT DOCUMENT: DO NOT QUOTE OR CITE
This document is currently under review by US EPA and its federal, state, and tribal partners, and is subject to change in whole or in part.

Prepared for:
The Lower Willamette Group

WE08-0002

Prepared by:

Windward environmental LLC
200 West Mercer Street, Suite 401 • Seattle, Washington • 98119

Recommended for Inclusion in Administrative Record

TABLE OF CONTENTS

LIST OF TABLES iv

LIST OF FIGURES iv

ACRONYMS v

1.0 INTRODUCTION 1
1.1 OBJECTIVES 1
1.2 REPORT ORGANIZATION 1

2.0 METHODS 2
2.1 FIELD METHODS 2
2.1.1 Surface Sediment Sampling 2
2.1.2 Field Deviations from FSP and QAPP 5
2.2 LABORATORY METHODS 5
2.2.1 *Chironomus dilutus* 5
2.2.2 *Hyalella azteca* 6
2.3 QA/QC PROCESS 7
2.3.1 Laboratory Quality Assurance 7
2.3.2 Data Validation 7

3.0 RESULTS 8
3.1 *CHIRONOMUS DILUTUS* TOXICITY TEST 8
3.1.1 Toxicity Test Results 8
3.1.2 QA/QC Results 13
3.2 *HYALELLA AZTECA* TOXICITY TEST 14
3.2.1 Toxicity Test Results 14
3.2.2 QA/QC Results 19

4.0 SUMMARY OF SEDIMENT TOXICITY TESTS 20

5.0 REFERENCES 21

APPENDIX A: EPA-LWG COMMUNICATIONS

APPENDIX B: DATA TABLES

APPENDIX C: LABORATORY TEST REPORTS

APPENDIX D: VALIDATION REPORT

APPENDIX E: CHAIN-OF-CUSTODY FORMS

LIST OF TABLES

Table 2-1. Collection and testing schedule of the 60 surface sediment samples 5
Table 3-1. Data summary for the sediment toxicity test with *Chironomus dilutus* 8
Table 3-2. Data summary for the sediment toxicity test with *Hyalella azteca* 15

LIST OF FIGURES

Figure 2-1. Round 3B bioassay stations 3
Figure 3-1. Round 3B bioassay data for *Chironomus* 11
Figure 3-2. Round 3B bioassay data for *Hyalella* 17

ACRONYMS

AFDW	ash-free dry weight
ASTM	American Society for Testing and Materials
EPA	US Environmental Protection Agency
FSP	field sampling plan
Integral	Integral Consulting, Inc.
LC50	concentration that is lethal to 50% of an exposed population
NAS	Northwestern Aquatic Sciences
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RI/FS	remedial investigation/feasibility study
RM	river mile
RSET	Regional Sediment Evaluation Team
Windward	Windward Environmental LLC

1.0 INTRODUCTION

The Portland Harbor remedial investigation/feasibility study (RI/FS) Round 3B sediment sampling efforts were designed to fill data gaps related to site characterization, ecological and human health risks, and the feasibility study (Integral et al. 2007). The sampling effort included surface and subsurface sediment chemistry and toxicity testing; the toxicity testing involved only surface sediment from selected locations. The toxicity testing and surface sediment chemistry data will be included in the overall dataset used in the two predictive models to characterize the relationship between sediment chemistry and benthic invertebrate toxicity at the Portland Harbor Superfund site. This report presents the results from the 10-day sediment toxicity test with *Chironomus dilutus* (formerly *C. tentans*) and the 28-day sediment toxicity test with *Hyalella azteca*. These tests were conducted on 56 surface sediment samples collected in the Willamette River within the Portland Harbor from River Mile (RM) 3.4 to RM 12.2, and 4 surface sediment samples collected at four upstream stations as described in the Portland Harbor RI/FS Round 2 Quality Assurance Project Plan (QAPP), the QAPP Addendum 10, Round 3B Field Sampling Plan (FSP) approved by the US Environmental Protection Agency (EPA), and the Field Sampling Report (Integral and Windward 2004; Integral et al. 2007; Windward 2007; Integral 2008).

1.1 OBJECTIVES

The objectives of this data report are to:

- Present the results from the 10-day sediment toxicity test with *C. dilutus* and the 28-day sediment toxicity test with *H. azteca* conducted on 60 sediment samples collected within and upstream of the Portland Harbor
- Provide information on the quality of the toxicity data, including field and laboratory deviations from the FSP and QAPP and data validation results.

1.2 REPORT ORGANIZATION

The report is organized into sections that address field methods, laboratory methods, quality assurance and quality control (QA/QC) procedures, results, and references. Supporting information is provided in several appendices:

- Appendix A: EPA-LWG Communications
- Appendix B: Complete Laboratory Test Data
- Appendix C: Laboratory Test Reports
- Appendix D: Bioassay Data Validation Report
- Appendix E: Chain-of-Custody Forms

2.0 METHODS

This section briefly describes the methods for the collection of surface sediment samples and the laboratory methods for conducting the 10-day *C. dilutus* and the 28-day *H. azteca* sediment toxicity tests. The details of the field and laboratory procedures are described in the Round 3B FSP, Round 2 QAPP, and QAPP Addendum 10 (Integral and Windward 2004; Integral et al. 2007; Windward 2007). Field and laboratory deviations from the FSP and QAPPs are also presented in this section. The laboratory reports are presented in full in Appendix C, and the chain-of-custody forms used to track sample custody are presented in Appendix E.

2.1 FIELD METHODS

Surface sediment samples for toxicity testing were collected at 56 stations within Portland Harbor (RM 2 to RM 12.2) and at 4 upstream stations (RM 15 to RM 26) in accordance with the Round 3B FSP, Round 2 QAPP, and QAPP Addendum 10 (Integral and Windward 2004; Integral et al. 2007; Windward 2007). This section briefly summarizes the field collection methods.

2.1.1 Surface Sediment Sampling

Surface (0 to 30 cm) sediment grab samples were collected for toxicity testing at 56 stations in Portland Harbor using a power grab sampler deployed from a sampling vessel (Integral 2008). In addition, four surface sediment samples were collected at four stations upstream of the Portland Harbor (Figure 2-1). The sediment at each station was homogenized and placed in jars for bioassay and chemistry analyses (for further details see the Round 3B FSP (Integral et al. 2007)). The bioassay laboratory, Northwestern Aquatic Sciences (NAS), conducted the two toxicity tests on the 60 sediment samples in four batches (two batches with each test organism). Each batch of 28 sediment samples from Portland Harbor was tested along with a negative control and reference sediment (the 4 upstream sediment samples). The toxicity tests were initiated within 23 days of the collection of the sediment samples. The sediment samples were collected and tested as presented in Table 2-1.

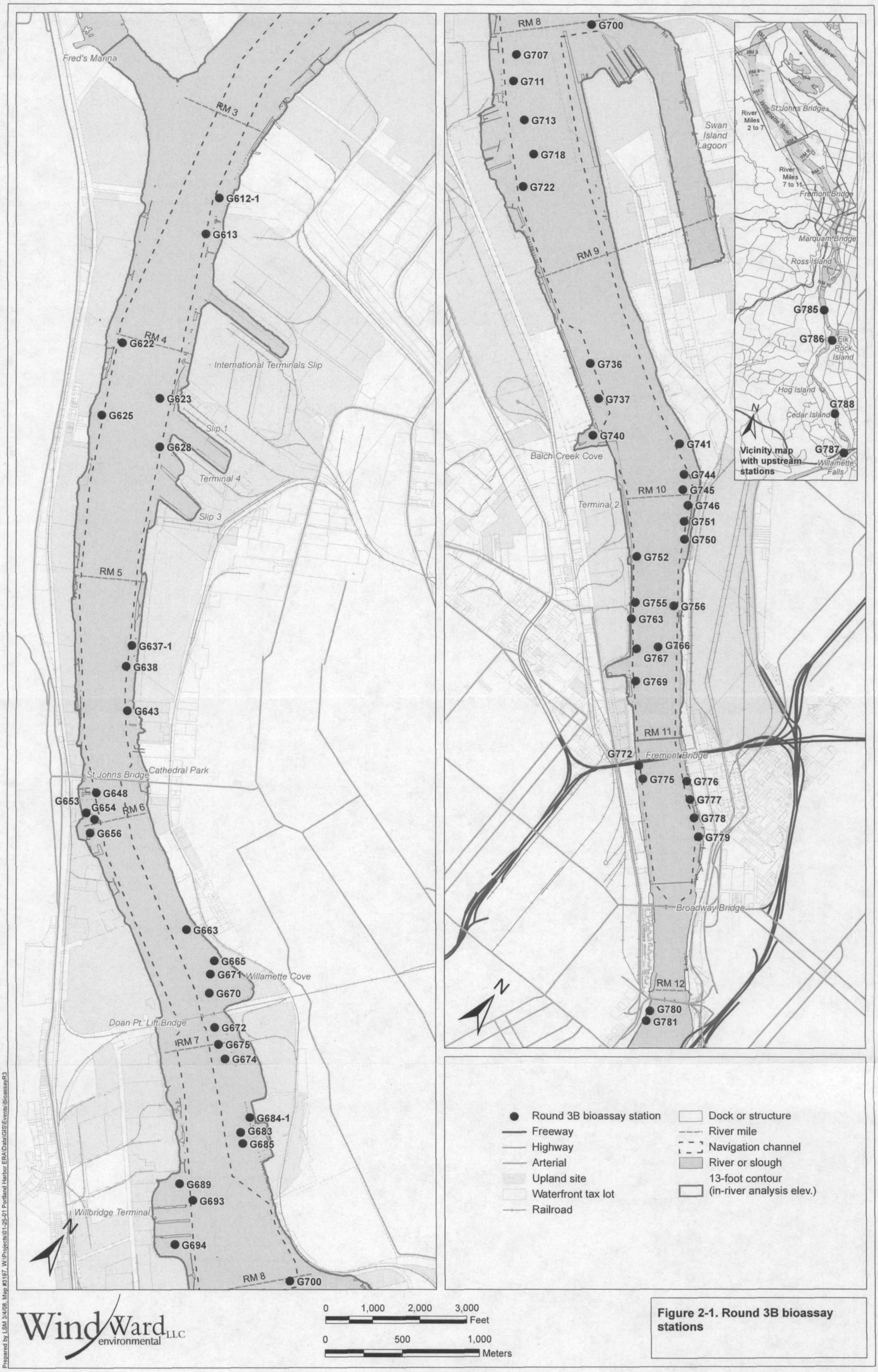


Figure 2-1. Round 3B bioassay stations

Prepared by LSM 3/4/08, Map #3197, W:\Projects\01-25-01 Portland Harbor ERA\Data\GIS\Events\BioassayR3

Table 2-1. Collection and testing schedule of the 60 surface sediment samples

Batch Number	Field Collection Date	Initiation Date for Toxicity Tests	Termination Date for *C.dilutus* Test	Termination Date for *H. azteca* Test
Batch 1	Nov 14 – 16, 2007	Nov 30, 2007	Dec 10, 2007	Dec 28, 2007
Batch 2	Nov 14 – 16, 2007, and Dec 5, 2007	Dec 7, 2007	Dec 17, 2007	Jan 4, 2008

2.1.2 Field Deviations from FSP and QAPP

The FSP was followed for the bioassay sediment collection with two modifications. At station LW3-G670, sediment was collected 76 ft from the target location because the recently installed McCormick & Baxter remediation cap extended over the target location; and at station LW3-G776, sediment was collected 64.3ft from the target location because gravel covered the area (Integral 2008). There were no deviations from field procedures presented in the QAPP.

2.2 LABORATORY METHODS

The 10-day *C. dilutus* and the 28-day *H. azteca* sediment toxicity tests were conducted on 56 sediment samples collected within Portland Harbor and 4 upstream sediment samples. The four upstream sediment samples were collected and analyzed as reference sediments, at locations representing a range of grain sizes and total organic carbon. The four stations were included as part of the Round 2 toxicity testing, and all four stations passed the acceptability criteria for reference sediments in the *Chironomus* test presented by the Regional Sediment Evaluation Team (RSET) in the *Regional Sediment Evaluation Framework for the Pacific Northwest* (RSET 2006). The reference acceptability criteria are $\leq$ 30% mortality and a final reference sediment growth $\geq$ 80% of final negative control growth. NAS conducted the sediment toxicity tests with *C. dilutus* and *H. azteca* according to the methods described in the Round 2 QAPP and QAPP Addendum 10 (Integral and Windward 2004; Integral et al. 2007; Windward 2007). A summary of the QA/QC results and the independent data validation results are provided in Sections 3.1.2 and 3.2.2 for *Chironomus* and *Hyalella,* respectively. The following sections briefly described each laboratory test method.

2.2.1 *Chironomus dilutus*

The 10-day *C. dilutus* sediment toxicity test was conducted according to American Society for Testing and Materials (ASTM) Method E 1706-00 (ASTM 2003) and EPA Method 100.2 (EPA 2000). In the 10-day sediment toxicity test, larvae (midges) were exposed to test, upstream reference, and negative control sediments. Negative control sediment was collected from a well-established area free of contaminants. The area is located approximately 1 mile east of the Highway 101 bridge at Beaver Creek, south of Newport, Oregon. Sediment from this area was used as the negative control in the

Round 2 sediment toxicity testing. The test was conducted with eight replicates per treatment, each containing 100 mL of sediment and 175 mL of overlying water. The test was initiated by adding 10 third instar larvae to each replicate. The test chamber position was randomized, as was the distribution of larvae in the test chambers. The test was performed at 23 ± 1°C with a photoperiod of 16L:8D. The overlying water was renewed twice daily, and the larvae were fed once daily. At day 10, the test was terminated, and the numbers of surviving organisms (i.e., larvae and pupae) in each replicate were counted and recorded. The surviving larvae from each replicate (pupae were not included in the growth determination) were dried at 60 to 90 °C to constant weight and weighed to the nearest 0.01 mg. The total weight of the dried larvae from each replicate was divided by the number of larvae weighed to obtain an average dry weight per surviving larva per replicate. The dried larvae were then ashed at 550 °C for 2 hours. The ashed larvae were reweighed, and the tissue mass of the larvae was calculated as the difference between the weight of the dried larvae and the weight of the ashed larvae. Pupae or adult organisms were not included in the replicate to estimate ash-free dry weight (AFDW). The growth endpoint was based on the AFDW measurements. The test was deemed acceptable if mean survival in the negative control was ≥ 70% and the mean weight of surviving negative control organisms was ≥ 0.48 mg AFDW. Further description of test method and data requirements are presented in the Round 2 QAPP and QAPP Addendum 10 (Integral and Windward 2004; Windward 2007).

2.2.2 *Hyalella azteca*

The 28-day *H. azteca* sediment toxicity test was conducted according to ASTM Method E 1706-00 (ASTM 2003) and EPA Method 100.4 (EPA 2000). In the 28-day sediment toxicity test, amphipods were exposed to test, upstream reference, and negative control sediments. Negative control sediment was collected from a well-established area free of contaminants. The area is located approximately 1 mile east of the Highway 101 bridge at Beaver Creek, south of Newport, Oregon. Sediment from this area was used as the negative control in the Round 2 sediment toxicity testing. The test was conducted with eight replicates per treatment, each containing 100 mL of sediment and 175 mL of overlying water. The test was initiated by adding 10 7- to 8-day-old amphipods to each replicate. The test chamber position was randomized, as was the distribution of amphipods in the test chambers. The test was performed at 23 ± 1°C with a photoperiod of 16L:8D. The overlying water was renewed twice daily, and the amphipods were fed once daily. At day 28, the test was terminated, and the numbers of surviving amphipods in each replicate were counted and recorded. The surviving amphipods from each replicate were dried at 60 to 90°C to constant weight and weighed to the nearest 0.01 mg. The total weight of the dried amphipods from each replicate was divided by the number of amphipods weighed to obtain an average dry weight per surviving amphipod per replicate. The test was deemed acceptable if mean survival in the negative control was ≥ 80%. Further description of test method and data requirements are presented in the Round 2 QAPP and QAPP Addendum 10 (Integral and Windward 2004; Windward 2007).

2.3 QA/QC PROCESS

The QA/QC process included three main components: the standard QA provided by NAS (the contract laboratory), a laboratory audit and protocol review by an independent third party, and 100% data validation, also conducted by the independent third party. This section briefly describes the three components of the QA/QC process.

2.3.1 Laboratory Quality Assurance

Both sediment toxicity tests incorporated standard QA/QC procedures for the evaluation of the validity of the test results. Standard QA/QC procedures included the use of negative and positive controls and the periodic measurement of water quality during testing. The laboratory technicians performing the tests were responsible for ensuring that the appropriate procedures were followed during the testing. The laboratory performed the first data reduction by calculating the average survival and biomass for each test sediment and the negative controls. An internal review of the data was performed by the laboratory's QA/QC officer. For further details on the QC procedures for sediment toxicity testing, refer to the Round 2 QAPP and the QAPP Addendum 10 (Integral and Windward 2004).

2.3.2 Data Validation

Paul Dinnel of Dinnel Marine Resources, an independent third party, reviewed the two test protocols written by NAS prior to commencement of the sediment toxicity study to ensure that protocols were up to date and included any recently published modifications. The reviewer found NAS protocols to be well written and in full compliance with EPA and ASTM protocols. The independent third-party reviewer conducted one unannounced laboratory audit during sediment testing. All testing procedures closely followed NAS's approved protocols, and all test parameters appeared to be within testing guidelines.

A 100% check was made of all data entered into NAS's internal database, and spot checks were made of all Microsoft Excel® spreadsheet calculations and formulas. All errors, omissions, clarifications, or changes were documented and communicated to NAS. Complete details of the data validation process are presented in Appendix D.

3.0 RESULTS

The results from the two sediment toxicity test with *C. dilutus* and *H. azteca* are presented below. The toxicity test data are presented in full in Appendix B, and the complete laboratory reports are presented in Appendix C. The validation report is presented in Appendix D.

3.1 *CHIRONOMUS DILUTUS* TOXICITY TEST

The 10-day *C. dilutus* sediment toxicity test was conducted on 56 sediment samples collected within the Portland Harbor and 4 sediment samples collected at upstream reference stations. This section presents the laboratory QA/QC and data validation results as well as the toxicity test results.

3.1.1 Toxicity Test Results

A summary of the validated data for the 10-day sediment toxicity test with *C. dilutus* is presented in Table 3-1 and Figure 3-1. The 56 sediment samples collected in Portland Harbor were tested in two batches of 28 sediment samples together with the negative control and the 4 upstream reference sediment samples. The negative control in the two batches passed the acceptability criteria of $\leq$ 30% mortality and a mean weight of surviving organisms $\geq$ 0.48 mg AFDW. In the negative control, the average mortality was 12.5 and 11.3%; and the average AFDW was 0.91 and 0.81 mg per organism. The four upstream sediment samples met the criteria for reference sediments stated in the Regional Sediment Evaluation Framework for the Pacific Northwest (RSET 2006) of $\leq$ 30% mortality and a final growth $\geq$ 80% of the final negative control growth. The average mortality at the four upstream stations ranged from 10 to 30% and the average AFDW from 0.73 to 1.01 mg per organism (80.2 to 117% of the final negative control growth). The average mortality in the test sediments ranged from 2.5% in LW3-G671 to 55% in LW3-G789. The average AFDW ranged from 0.52 mg per organism in LW3-G654 to 1.05 mg per organism in LW3-G772.

Table 3-1. Data summary for the sediment toxicity test with *Chironomus dilutus*

Negative Control or Station Names	Average Percent Mortality (Standard Deviation)		Average Ash-Free Dry Weight (mg) (Standard Deviation)	
Batch 1				
Negative Control	**12.5**	**(12.8)**	**0.91**	**(0.06)**
LW3-G785 (reference)	**13.8**	**(9.2)**	**1.01**	**(0.13)**
LW3-G786 (reference)	**12.5**	**(12.8)**	**0.93**	**(0.12)**
LW3-G787 (reference)	**12.5**	**(12.8)**	**0.98**	**(0.09)**
LW3-G788 (reference)	**10.0**	**(9.3)**	**0.73**	**(0.08)**
LW3-G612	8.8	(11.3)	0.81	(0.04)
LW3-G622	23.8	(18.5)	0.91	(0.14)

Table 3-1. Data summary for the sediment toxicity test with *Chironomus dilutus*

Negative Control or Station Names	Average Percent Mortality (Standard Deviation)		Average Ash-Free Dry Weight (mg) (Standard Deviation)	
LW3-G623	12.5	(12.8)	0.84	(0.07)
LW3-G625	4.3	(5.3)	0.84	(0.07)
LW3-G628	13.8	(13.0)	0.84	(0.06)
LW3-G637	15.0	(14.1)	0.90	(0.12)
LW3-G638	6.3	(7.4)	0.86	(0.09)
LW3-G643	15.7	(17.2)	0.88	(0.16)
LW3-G648	10.0	(10.7)	0.81	(0.09)
LW3-G653	11.3	(13.6)	0.77	(0.07)
LW3-G654	31.3	(28.5)	0.52	(0.19)
LW3-G663	17.5	(11.6)	0.73	(0.10)
LW3-G665	17.5	(16.7)	0.92	(0.15)
LW3-G671	2.5	(4.6)	0.78	(0.10)
LW3-G674	13.8	(9.2)	0.83	(0.06)
LW3-G683	11.3	(11.3)	0.81	(0.05)
LW3-G685	8.8	(11.3)	0.84	(0.14)
LW3-G689	55.0	(35.9)	0.83	(0.14)
LW3-G693	13.8	(16.0)	0.79	(0.14)
LW3-G694	10.0	(10.7)	0.63	(0.06)
LW3-G700	12.5	(11.6)	0.81	(0.12)
LW3-G707	11.3	(12.5)	0.82	(0.07)
LW3-G711	12.5	(8.9)	0.85	(0.10)
LW3-G713	16.3	(16.0)	0.84	(0.09)
LW3-G718	11.3	(12.5)	0.77	(0.09)
LW3-G722	7.5	(8.9)	0.75	(0.11)
LW3-G736	7.5	(10.4)	0.86	(0.11)
LW3-G737	18.8	(14.6)	0.85	(0.08)
Batch 2				
Negative control	**11.3**	**(11.3)**	**0.81**	**(0.09)**
LW3-G785 (reference)	**17.5**	**(13.9)**	**0.95**	**(0.10)**
LW3-G786 (reference)	**18.8**	**(12.5)**	**0.84**	**(0.12)**
LW3-G787 (reference)	**30.0**	**(13.1)**	**0.83**	**(0.06)**
LW3-G788 (reference)	**16.3**	**(14.1)**	**0.78**	**(0.10)**
LW3-G613	10.0	(10.7)	0.80	(0.09)
LW3-G656	18.8	(16.4)	0.78	(0.15)
LW3-G670	20.0	(9.3)	0.98	(0.16)
LW3-G672	32.5	(22.5)	0.89	(0.19)
LW3-G675	12.5	(10.4)	0.89	(0.08)
LW3-G684	11.3	(13.6)	0.81	(0.09)
LW3-G740	15.0	(15.1)	0.88	(0.06)
LW3-G741	11.3	(13.6)	0.87	(0.12)

Table 3-1. Data summary for the sediment toxicity test with *Chironomus dilutus*

Negative Control or Station Names	Average Percent Mortality (Standard Deviation)		Average Ash-Free Dry Weight (mg) (Standard Deviation)	
LW3-G744	25.0	(20.7)	0.95	(0.09)
LW3-G745	10.0	(13.1)	0.84	(0.10)
LW3-G746	22.5	(13.9)	0.88	(0.12)
LW3-G750	22.5	(14.9)	0.85	(0.14)
LW3-G751	15.0	(17.7)	0.88	(0.13)
LW3-G752	21.3	(30.9)	0.93	(0.06)
LW3-G755	15.0	(10.7)	0.98	(0.15)
LW3-G756	23.8	(27.7)	0.95	(0.08)
LW3-G763	13.8	(11.9)	1.03	(0.14)
LW3-G766	15.0	(12.0)	0.96	(0.14)
LW3-G767	8.8	(17.3)	0.84	(0.10)
LW3-G769	20.0	(23.3)	0.92	(0.10)
LW3-G772	13.8	(15.1)	1.05	(0.17)
LW3-G775	8.8	(8.3)	1.00	(0.08)
LW3-G776	8.8	(11.3)	1.04	(0.11)
LW3-G777	17.5	(16.7)	0.83	(0.12)
LW3-G778	28.8	(28.5)	0.97	(0.27)
LW3-G779	22.5	(28.7)	0.95	(0.09)
LW3-G780	13.8	(15.1)	0.97	(0.11)
LW3-G781	15.0	(9.3)	0.87	(0.07)

Figure 3-1. Round 3B bioassay data for *Chironomus*

Prepared by LSM 3/21/08, map 3169: W:\Projects\01-25-01 Portland Harbor ERA\Data\GIS\Events\BioassayR3

3.1.2 QA/QC Results

This section presents the results of the standard QA procedures for conducting the 10-day *C. dilutus* sediment toxicity test provided by NAS, 100% data validation conducted by Dinnel Marine Resources, and laboratory deviations from the Round 2 QAPP and QAPP Addendum 10 (Integral and Windward 2004; Windward 2007).

3.1.2.1 Laboratory QA/QC Results

The standard QA data provided by the laboratory included acceptable negative and positive controls and water quality measurements within specified acceptable ranges.

The negative control in a 10-day sediment toxicity test with *C. dilutus* must have an average morality of less than 30% and an average AFDW greater than 0.48 mg per organism. The average mortality in the negative control in the two sediment toxicity tests met the acceptability criterion with values of 12.5 and 11.3%. The average AFDW for the negative control in the two tests met the acceptability criterion with values of 0.91 to 0.81 mg per organism.

The positive control consists of a 96-hour reference toxicant test conducted with the same batch of test organisms used in the sediment toxicity test. The reference toxicant used for the *C. dilutus* test was potassium chloride (KCl). The mean mortality in a 0-g KCl/L concentration (negative control) should be less than 10%, and the calculated LC50 (concentration that is lethal to 50% of an exposed population) value for each test should be within ± 2 standard deviations of the calculated mean of the control chart. The average mortality was 0% in both reference toxicant tests, and the LC50 values for the two reference toxicant tests fell within ±2 standard deviations of the calculated mean of the control chart. The positive control data for each test are presented in the laboratory reports in Appendix C.

The water quality measurements in all sediment and reference toxicant tests were within the specified acceptable ranges, with the exception of two slight deviations in temperature (see Section 3.1.2.3). Further details on laboratory audits and data validation are presented in full in Appendix D.

3.1.2.2 Data Validation

A 100% validation of the toxicity test data from NAS was performed by comparing the electronic data files with the raw laboratory data sheets and ensuring that calculation formulas in the data spreadsheets were correct. All transcription errors, incorrect formulas, and other inconsistencies in the electronic data were corrected by NAS and verified by the independent reviewer before the data were finalized. Further details on the data validation process are presented in Appendix D.

3.1.2.3 Laboratory Deviations from QAPP

The sediment toxicity tests with *C. dilutus* were conducted according to the QAPP except for the deviations outlined below. These deviations were deemed minor by the

independent third party with no effect on the results. The data validation report is presented in detail in Appendix D.

- In Batch 1, on day 3, the temperature in two beakers was 24.1 °C, which was slightly over the protocol limit of 23 ± 1°C. In Batch 2, on day 10, the temperature in eight beakers was 21.9°C, which was slightly lower than the protocol limit.
- In Batch 1, four beakers inadvertently received 11 organisms at test initiation instead of the protocol-designated 10.
- In Batch 1, replication was eight-fold for all samples as specified by ASTM and EPA protocols except for two samples (LW3-G625 and LW3-G643), which had a replication of seven-fold.

3.2 *HYALELLA AZTECA* TOXICITY TEST

The 28-day *H. azteca* sediment toxicity test was conducted on 56 sediment samples collected within Portland Harbor and 4 sediment samples collected at upstream reference stations. This section presents the laboratory QA/QC and data validation results as well as the toxicity test results.

3.2.1 Toxicity Test Results

A summary of the validated data for the 28-day sediment toxicity test with *H. azteca* is presented in Table 3-2 and Figure 3-2. The 56 sediment samples collected in Portland Harbor were tested in two batches of 28 sediment samples together with the negative control and the 4 upstream reference sediment samples. The negative control in the two batches passed the acceptability criterion of ≤ 20% mortality with average mortalities of 10.1 and 0%. In addition, the negative controls met the growth criterion stated in the Regional Sediment Evaluation Framework for the Pacific Northwest (RSET 2006) of ≥ 0.15 mg per surviving organism. The four upstream sediment samples tested in the two batches met the mortality criterion for reference sediments of ≤ 30% mortality as stated in RSET (2006), with average mortalities ranging from 10 to 30%. The sediment sample collected at upstream station LW3-G788 and tested in Batch 1 met the reference sediment growth criterion of ≥ 0.15 mg per surviving organism as stated in RSET (2006). The other three sediment samples collected at upstream stations and tested in Batch 1 had a final growth ranging from 0.12 to 0.14 mg per surviving organism and therefore did not meet the growth criterion for reference sediments. In Batch 2, three of the four sediment samples collected at upstream stations met the reference sediment growth criterion with a final growth of 0.18 mg per surviving organism. The sediment sample collected at station LW3-787 had a final growth of 0.14 mg per organism and thus did not meet the growth criterion for reference sediments. The average mortality in the test sediments ranged from 1.3% in LW3-G683 to 22.5% in LW3-G777. The average growth ranged from 0.11 mg per organism in LW3-G612, LW3-G671,

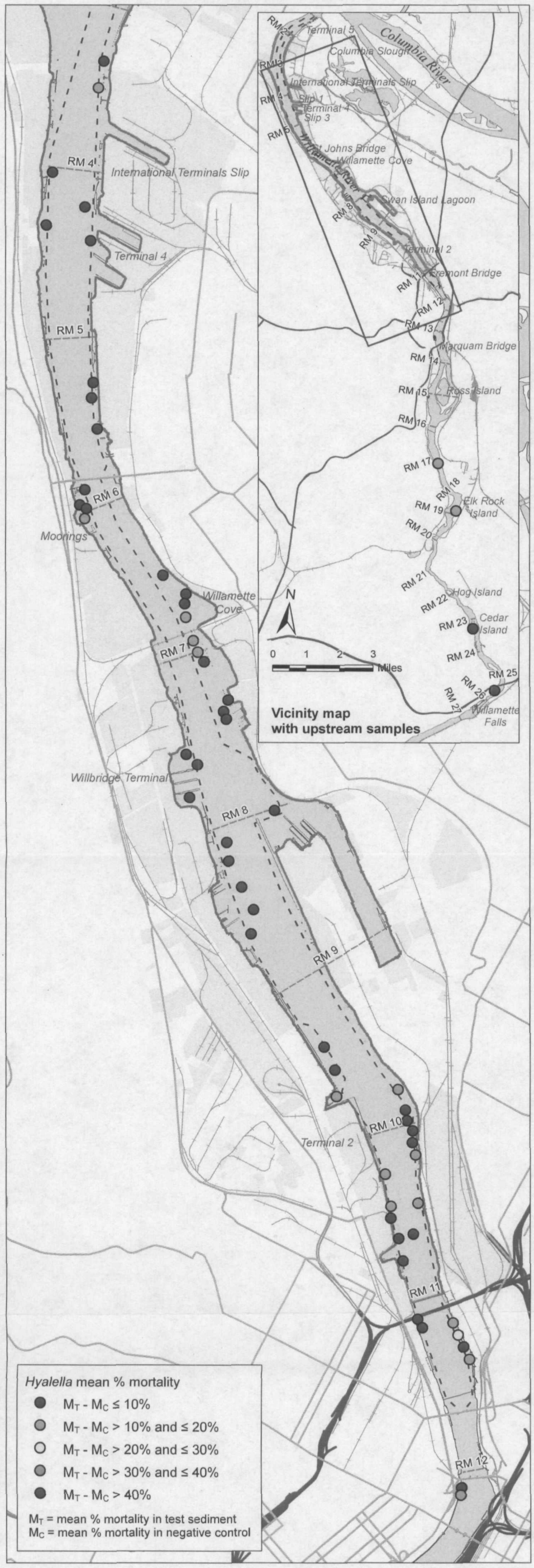
LW3-G685, LW3-G693, LW3-G694, and LW3-G713 to 0.24 mg per organism in LW3-G777.

Table 3-2. Data summary for the sediment toxicity test with *Hyalella azteca*

Negative Control or Station Name	Average Percent Mortality (Standard Deviation)		Average Dry Weight (mg) (Standard Deviation)	
Batch 1				
Negative Control	**10.1**	**(10.7)**	**0.19**	**(0.04)**
LW3-G785 (reference)	**3.8**	**(7.4)**	**0.12**	**(0.02)**
LW3-G786 (reference)	**18.8**	**(6.4)**	**0.14**	**(0.04)**
LW3-G787 (reference)	**7.5**	**(13.9)**	**0.12**	**(0.01)**
LW3-G788 (reference)	**11.3**	**(13.6)**	**0.15**	**(0.04)**
LW3-G612	7.5	(8.9)	0.11	(0.02)
LW3-G622	12.5	(10.4)	0.13	(0.01)
LW3-G623	15.0	(10.7)	0.13	(0.01)
LW3-G625	5.0	(7.6)	0.12	(0.01)
LW3-G628	8.8	(16.4)	0.12	(0.03)
LW3-G637	8.8	(11.3)	0.12	(0.02)
LW3-G638	12.5	(13.9)	0.12	(0.02)
LW3-G643	10.0	(14.1)	0.13	(0.02)
LW3-G648	10.0	(9.3)	0.12	(0.02)
LW3-G653	16.3	(14.1)	0.13	(0.02)
LW3-G654	13.8	(9.2)	0.14	(0.05)
LW3-G663	10.0	(14.1)	0.12	(0.03)
LW3-G665	12.5	(10.4)	0.12	(0.01)
LW3-G671	13.8	(13.0)	0.11	(0.01)
LW3-G674	15.0	(13.1)	0.12	(0.03)
LW3-G683	1.3	(3.5)	0.12	(0.01)
LW3-G685	6.3	(10.6)	0.11	(0.02)
LW3-G689	8.8	(9.9)	0.13	(0.02)
LW3-G693	10.0	(13.1)	0.11	(0.02)
LW3-G694	3.8	(5.2)	0.11	(0.01)
LW3-G700	10.0	(13.1)	0.12	(0.01)
LW3-G707	16.3	(11.9)	0.12	(0.02)
LW3-G711	12.5	(13.9)	0.12	(0.02)
LW3-G713	6.3	(7.4)	0.11	(0.01)
LW3-G718	8.8	(11.3)	0.12	(0.01)
LW3-G722	13.8	(9.2)	0.12	(0.01)
LW3-G736	11.3	(14.6)	0.13	(0.01)
LW3-G737	16.3	(15.1)	0.13	(0.02)
Batch 2				
Negative Control	**0.0**	**(0.0)**	**0.21**	**(0.02)**
LW3-G785 (reference)	**15.0**	**(27.3)**	**0.18**	**(0.06)**
LW3-G786 (reference)	**15.0**	**(9.3)**	**0.18**	**(0.02)**

Table 3-2. Data summary for the sediment toxicity test with *Hyalella azteca*

Negative Control or Station Name	Average Percent Mortality (Standard Deviation)		Average Dry Weight (mg) (Standard Deviation)	
LW3-G787 (reference)	**8.8**	**(14.6)**	**0.14**	**(0.02)**
LW3-G788 (reference)	**10.0**	**(10.7)**	**0.18**	**(0.03)**
LW3-G613	11.3	(8.3)	0.15	(0.02)
LW3-G656	12.5	(18.3)	0.16	(0.02)
LW3-G670	13.8	(11.9)	0.17	(0.03)
LW3-G672	11.3	(9.9)	0.14	(0.02)
LW3-G675	12.5	(11.6)	0.17	(0.02)
LW3-G684	6.3	(9.2)	0.16	(0.02)
LW3-G740	13.8	(13.0)	0.19	(0.03)
LW3-G741	11.3	(13.6)	0.15	(0.02)
LW3-G744	10.0	(12.0)	0.16	(0.02)
LW3-G745	10.0	(14.1)	0.16	(0.02)
LW3-G746	8.8	(9.9)	0.16	(0.01)
LW3-G750	16.3	(13.0)	0.16	(0.02)
LW3-G751	10.0	(9.3)	0.19	(0.02)
LW3-G752	15.0	(16.9)	0.15	(0.03)
LW3-G755	12.5	(12.8)	0.17	(0.02)
LW3-G756	20.0	(14.1)	0.19	(0.01)
LW3-G763	7.5	(10.4)	0.17	(0.03)
LW3-G766	10.0	(12.0)	0.17	(0.02)
LW3-G767	6.3	(10.6)	0.18	(0.02)
LW3-G769	8.8	(14.6)	0.18	(0.03)
LW3-G772	7.5	(11.6)	0.18	(0.02)
LW3-G775	10.0	(16.0)	0.16	(0.03)
LW3-G776	16.3	(34.6)	0.17	(0.02)
LW3-G777	22.5	(27.6)	0.24	(0.07)
LW3-G778	8.8	(11.3)	0.18	(0.03)
LW3-G779	16.3	(18.5)	0.19	(0.04)
LW3-G780	3.8	(7.4)	0.20	(0.04)
LW3-G781	13.8	(23.9)	0.16	(0.03)



Wind Ward environmental LLC

Figure 3-2. Round 3B bioassay data for *Hyalella*

Prepared by LSM 3/21/08 map 3170 W:\Projects\01-25-01 Portland Harbor EBA\Data\GIS\Events\Bioassay\R3

3.2.2 QA/QC Results

This section presents the results the standard QA for conducting the 28-day *H. azteca* sediment toxicity test provided by NAS, 100% data validation conducted by Dinnel Marine Resources, and laboratory deviations from the Round 2 QAPP and QAPP Addendum 10 (Integral and Windward 2004; Windward 2007).

3.2.2.1 Laboratory QA/QC Results

The standard QA provided by the laboratory included acceptable negative and positive controls and water quality measurements within specified acceptable ranges. The negative control in a 28-day sediment toxicity test with *H. azteca* must have an average mortality of less than 20%. The average mortality in the negative controls met the acceptability criterion with values of 10.1 and 0%.

The positive control consisted of a 96-hour reference toxicant test conducted with the same batch of test organisms used in the sediment toxicity test. The reference toxicant used for the *H. azteca* test was cadmium chloride ($CdCl_2$). The mean mortality in a 0-g $CdCl_2$/L concentration (negative control) should be less than 10%, and the calculated LC50 value for each test should be within ± 2 standard deviations of the calculated mean of the control chart. Both these criteria were met for the two reference toxicant tests. The positive control data for each test are presented in the laboratory reports in Appendix B.

The water quality measurements in all sediment and reference toxicant tests were within the specified acceptable ranges, except for one slight deviation in temperature in Batch 2 (see Section 3.2.2.3). Further details on laboratory audits and data validation are presented in full in Appendix C.

3.2.2.2 Data Validation

A 100% validation of the toxicity test data from NAS was performed by comparing the electronic data files with the raw laboratory data sheets and ensuring that calculation formulas in the data spreadsheets were correct. All transcription errors, incorrect formulas, and other inconsistencies in the electronic data were corrected by NAS and verified by the independent reviewer before the data were finalized. Further details on the data validation process are presented in Appendix C.

3.2.2.3 Laboratory Deviations from QAPP

The sediment toxicity tests with *H. azteca* were conducted according to the QAPP, except for the deviations in Batch 2 outlined below. These deviations were deemed minor by the independent third party with no effect on the results. The data validation report is presented in detail in Appendix C.

- Two beakers inadvertently received 11 and 12 organisms, respectively, at test initiation instead of the protocol-designated 10.
- Temperature on Day 12 in one beaker was 21.9 °C, which was slightly under the protocol limit of 23 ±1 °C.

4.0 SUMMARY OF SEDIMENT TOXICITY TESTS

The 10-day *C. dilutus* and 28-day *H. azteca* sediment toxicity tests were conducted on 60 sediment samples collected within and upstream of the Portland Harbor Study Area. The tests were conducted in four batches (two batches with each test organism), and all batches met the specified test acceptability criteria. The independent third-party reviewer found all data generated by both tests to be of excellent quality and fully usable for any future application. The minor protocol deviations were deemed to have no adverse affect on the quality of the data.

5.0 REFERENCES

ASTM. 2003. Standard test methods for measuring the toxicity of sediment-associated contaminants with freshwater invertebrates. ASTM Standard Method No. E 1706-00. American Society for Testing and Materials, Philadelphia, PA.

EPA. 2000. Methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates. EPA/600/R-99/064. March 2000. US Environmental Protection Agency, Washington, DC.

Integral, Windward. 2004. Portland Harbor RI/FS: Round 2 quality assurance project plan. Prepared for Lower Willamette Group. June 24, 2004. Integral Consulting, Inc., Mercer Island, WA and Windward Environmental LLC, Seattle, WA.

Integral, Windward, Anchor. 2007. Portland Harbor RI/FS. Round 3B comprehensive sediment and bioassay testing field sampling plan. IC07-0024. Prepared for the Lower Willamette Group. November 5, 2007. Integral Consulting, Inc., Mercer Island, WA; Windward Environmental LLC, Seattle, WA; Anchor Environmental, LLC, Portland, OR.

Integral. 2008. Portland Harbor RI/FS. Round 3B comprehensive sediment and bioassay testing field sampling report. IC08-0004. Prepared for the Lower Willamette Group. March 21, 2008. Integral Consulting, Inc., Mercer Island, WA.

RSET. 2006. Regional sediment evaluation framework for the Pacific Northwest. Interim final. September 2006. Regional Sediment Evaluation Team (US Army Corps of Engineers - Seattle District, Portland District, Walla Walla District, and Northwestern Division; US Environmental Protection Agency Region 10; Washington Department of Ecology; Washington Department of Natural Resources; Oregon Department of Environmental Quality; Idaho Department of Environmental Quality; National Marine Fisheries Service; US Fish and Wildlife Service).

Windward. 2007. Portland Harbor RI/FS Round 3B quality assurance project plan addendum 10. Attachment 1: Sediment toxicity testing. WW07-0011. Prepared for Lower Willamette Group. December 5, 2007. Integral Consulting, Inc., Mercer Island, WA.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

TARGET SHEET

The document below is scanned IN PARTS.
This is due to the Original being:

_____	Oversized
X	CD Rom
_____	Computer Disk
_____	Video Tape
	Other: _____
	_____

**A copy of the document may be requested from the Superfund Records Center.

Document Information

Document ID #: 1309204

File #: 2.7.1-4

Site Name: PORSF

ROUND 3B BIOASSAY TESTING DATA REPORT
APPPENDICES A-E

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

TARGET SHEET

The document below is scanned IN PARTS.
This is due to the Original being:

_____	Oversized
X	CD Rom
_____	Computer Disk
_____	Video Tape
	Other: _____
	_____

**A copy of the document may be requested from the Superfund Records Center.

Document Information

Document ID #: 1309204

File #: 2.7.1-4

Site Name: PORSF

ROUND 3B BIOASSAY TESTING DATA REPORT
APPPENDICES A-E (COPY)